

A LEGACY SLOPE FAILURE IN PENLEE QUARRY - A WARNING TO OTHERS

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Penlee Quarry has a 90 m high slope which is 50-60 years old and is showing increasing signs of instability with two significant collapses in 2010 and 2011. The latter collapse gave rise to a possible flow slide at the toe and a significant air blast. This paper presents details of the underlying joints controlling ground movements, the investigation of these joints and proposals for remedial works. There are implications for other similar slopes elsewhere in England.

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INTRODUCTION

Penlee Quarry is a large quarry in West Cornwall that has been in operation since the late 1880s. It was a major producer of aggregate, but since 2003 under new ownership, quarry operations have concentrated on maintenance and preparatory works for the recovery of armourstone and the eventual construction of a marina.

The western face of this quarry was excavated between the 1950s and 1970s and is akin to other legacy slopes found at several older British quarries. The slope is up to 90 m in height, has little benching and has shown increasing signs of instability since 2005. Initially instability was evidenced by rockfall and more recently by serious collapses that have indicated the need for appropriate geotechnical design of a new replacement slope.

This paper sets out background and historical data and then considers investigations into the underlying mechanisms and rock structures that have contributed to instability and are relevant to the design of measures to overcome the potential for future significant ground movements. Methods to assess remotely the controlling joint sets are discussed and the rationale behind the stabilisation measures to facilitate future workings is outlined.

High, over-steep rock faces with limited, ineffective benching and excessive bench heights that may be found in some older quarries, as at Penlee, are likely to become a matter of increasing concern. In addition the potential for major air blast or flow slide phenomena needs further investigation in these legacy slopes some of which are present in South-West England.

SETTING

Penlee Quarry lies on the southern side of Newlyn, in West Cornwall. Located within the metamorphic aureole of the Land's End Granite it is comprised of metadolerite, a metabasic igneous rock, which intrudes into the surrounding Devonian metasediments (Figure 1). The quarry covers an area of

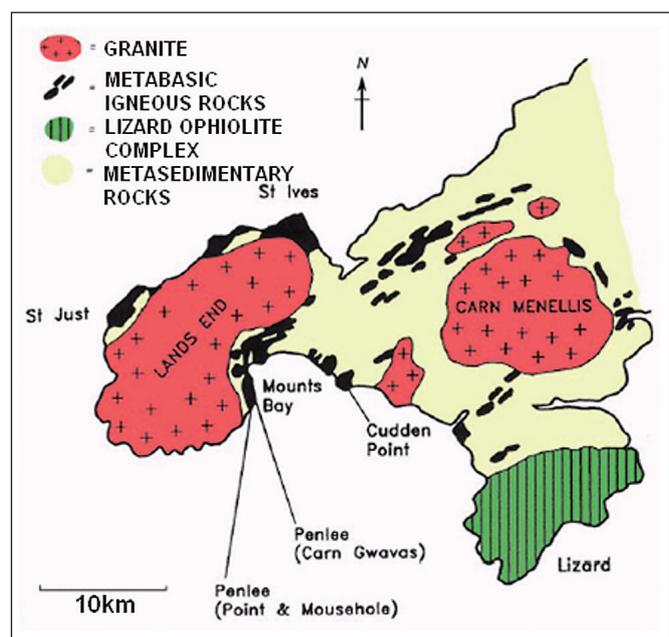


Figure 1. Geological map of West Cornwall showing the location of the metabasic igneous rocks and the general location of Penlee Quarry at Carn Guavas. After Denby (2004).